

REMARKS

Applicants submit the following remarks in response to the first Office Action dated March 28, 2003, in the above-identified patent application.

I. Restriction Requirement

In response to the restriction requirement, Group I, including claims 1-27, 36-38, and 40-42, is provisionally elected with traverse. Applicants submit that the restriction requirement between Groups I and III is improper because the test of MPEP 806.05(c) is not met. In particular, the second part of the test of MPEP 806.05(c) is not met -- the invention of Group III (what the Examiner calls the subcombination) does not have utility by itself or in different relations.

Contrary to the Examiner's assertions, the inventions of Groups I and III have the same utility. In particular, the invention of claim 1 (in Group I) and the invention of claim 33 (Group III) each include at least one large mode field size dielectric waveguide to interface with an external optical device, at least one low minimum bending radius waveguide coupled to the large mode field size dielectric waveguide, and at least one optical function connected to the low minimum bending radius dielectric waveguide. The utility of the invention of Group III is the same as the utility of the invention of Group I. In particular, both groups of inventions are useful as optical chips or substrates that can be used to miniaturize the optical chips. The Examiner's assertion that the "subcombination [Group III] has separate utility such as in semiconductor interconnection, switching, and a variety of opto-electric applications" is not correct. The invention of Group I also can have utility in switching and a variety of opto-electric applications. Although Applicants are not entirely sure what the Examiner has in mind by the term "semiconductor interconnection," Applicants submit that, to the extent the invention of Group III has utility in such an application, the invention of Groups I and III both have utility in the same manner in this regard.

In view of the foregoing, Applicants respectfully request that the restriction requirement for Groups I and III be withdrawn upon consideration. In addition, if the Examiner maintains this restriction requirement, the Applicants respectfully request that the examiner document a viable separate utility for the inventions of Groups I and III.

II. Drawings

The Examiner objected to Figure 1 of the drawings as not being labeled with a “Prior Art” designation. In amended Figure 1, which is attached as a replacement sheet having Figures 1-2, there is a “Prior Art” designation. Applicants therefore submit that this objection has been overcome.

III. Response to Objections to the Claims

The Examiner objected to the use of the word “similar” in claims 11 and 13. In particular, the Examiner asserted that the term “similar is not defined by the claims and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.” (March 28, 2003 Office Action, p. 4) Although Applicants do not agree with the Examiner in this regard, Applicants have amended claims 11 and 13 in order to expedite prosecution. As such, Applicants submit that this ground for objection has been overcome.

The Examiner also objected to claim 26, stating that “a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations.” (March 28, 2003 Office Action, p. 4) Applicants respectfully traverse the Examiner’s objection. Claim 26 does not recite a manner in which the apparatus can be used. Instead, claim 26 specifies that the “graded index region reduces scattering loss.” This is a structural characteristic of the claimed apparatus. In particular, the graded index region is constructed so that it “reduces scattering loss.” It is possible, for instance, that some graded index regions might not reduce scattering loss to an appreciable degree. This claim, therefore, further limits claim 20 by specifying that the graded index region is sufficient to reduce scattering loss. This is not a recitation of how the claimed apparatus can be used. As such, Applicants respectfully submit that this ground for objection has been overcome.

The Examiner also objected to claim 42, asserting that the language “adapted to” is not a positive limitation. Although Applicants do not agree with the Examiner in this regard, Applicants have amended claim 42 in order to expedite prosecution. As such, Applicants submit that this ground for rejection has been overcome.

IV. Response to Obviousness Rejections

In the first Office Action, the Examiner rejected all of the examined claims as being obvious under 35 U.S.C. §103. The Examiner rejected claims 1-4, 14-16, 29 [sic, should be 17-19, 27], 36, and 40-42 under 35 U.S.C. §103 as being unpatentable over what the Examiner called “Applicant’s Admission of Prior Art (AAPA)” in view of U.S. Patent No. 5,737,458 to Wojnarowski (the “Wojnarowski patent”). In rejecting independent claim 1, the Examiner stated that “AAPA” shows “an optical chip (pg. 1, lines 17-18) having at least one large mode field size dielectric waveguide (fig. 1; pg. 1, lines 17-18) that interfaces with an external optical device (pg. 1, lines 20-22), at least one low minimum bending radius dielectric waveguide (pg. 2, lines 15-17), and at least one optical function (pg. 1, lines 17-18) connected to the low minimum bending radius waveguide.” (March 28, 2003 Office Action, p. 6) Applicants respectfully traverse the Examiner’s rejection.

Applicants submit that the Examiner has mischaracterized the disclosure in the background section of Applicants’ patent application in rejecting the claims. What the Examiner calls “Applicant’s Admission of Prior Art (AAPA)” is not, in fact, such an admission. The background section does not disclose an optical chip having all of the features set forth above, as asserted by the Examiner. In particular, the background section of Applicants’ patent application does not disclose an optical chip with “at least one large mode field size dielectric waveguide,” “at least one low minimum bending radius dielectric waveguide,” and “at least one optical function … connected to the low minimum bending radius waveguide,” as asserted by the Examiner.

The cited portion of the background of Applicants’ patent application discloses that “Integrated optical chips with optical functions typically use low index difference waveguides, and these optical chips generally contain up to only two or three optical functions.” (Patent application, p. 1, ll. 17-18) The background does not disclose that these same optical chips also contain low minimum bending radius waveguides, as asserted by the Examiner. In fact, the section of Applicants’ background cited by the Examiner for this feature states only that “The use of higher index difference waveguides reduces the minimum bending radii while maintaining adequate performance (that is, low loss), and therefore reduces the area required to perform the optical functions.” (Patent application, p. 2, ll. 15-17) This statement does not disclose or

suggest that a single optical chip in the prior art contained at least one large mode field size waveguide, at least one low minimum bending radius waveguide, and at least one optical function connected to the low minimum bending radius waveguide. Instead, the sections of Applicants' background section cited by the Examiner merely set forth that high index difference waveguides existed, as did low index difference waveguides, and that there are some problems that result from using typical high index difference waveguides that existed at the time.

The claimed invention of independent claim 1 provides for the use of at least one optical function connected to a low minimum bending radius waveguide on an optical chip. The low minimum bending radius waveguide is coupled to a large mode field size waveguide, which is used to interface with an external optical device. The use of low minimum bending radius waveguides connected to optical functions allows a large numbers of optical functions to be integrated on a single optical chip having a small footprint. At the same time, the use of a large mode field size waveguide for interfacing to external optical devices allows for efficient coupling to devices, such as optical fibers, external to the optical chip. These features are not identified as being in the prior art in the background of Applicants' patent application, which the Examiner refers to as "AAPA."

What is completely absent from "AAPA" is a disclosure of "at least one low minimum bending radius dielectric waveguide coupled to the large mode field size dielectric waveguide," as included in independent claim 1. In fact, the Examiner did not even assert that "AAPA" or any other cited reference contains such a disclosure. In addition, as the Examiner expressly stated, "AAPA fails to disclose the large mode field size dielectric waveguide, the low minimum bending radius dielectric waveguide, and the optical function being fabricated monolithically on a single substrate." (March 28, 2003 Office Action, p. 6) Thus, even according to the Examiner, "AAPA" does not disclose at least two features of the claimed invention.

The Wojnarowski patent does not cure any of the deficiencies of "AAPA." The Wojnarowski patent generally discloses the use of optical interconnects within a HDI-like (high density interconnect -like) module. The Wojnarowski patent does not disclose or suggest the use of large mode field size waveguides and low minimum bending radius waveguides on an optical chip. Instead, the Wojnarowski patent, at least in part, seeks to merge HDI technology and optical waveguide technology. (Wojnarowski patent, col. 2, ll. 27-30)

The rejection of independent claim 1 should be removed because the cited references, alone or in combination, do not teach or suggest all of the claimed features. The Office Action does not, therefore, establish a *prima facie* case of obviousness because the prior art references do not teach or suggest all of the claim limitations. (MPEP § 2143.03) In addition, the Examiner has not established a *prima facie* case of obviousness because he has not established a proper motivation to combine “AAPA” (even if it were prior art, which Applicants do not concede) with the Wojnarowski patent. The Examiner asserts that the motivation in the Wojnarowski patent is “to provide an optimum platform for a high density interconnect structure (col. 1, lines 20-35).” (March 28, 2003 Office Action, p.6) This “motivation” is improper for at least two reasons. First, the cited section of the Wojnarowski patent relates to “electronic systems.” (Wojnarowski patent, col. 1, l. 20) Second, there is no disclosure or identification of large mode field size waveguides and low minimum bending radius waveguides anywhere in the Wojnarowski patent. Thus, the Wojnarowski patent would not provide a motivation to a person of ordinary skill in the art to couple large mode field size waveguides with low minimum bending radius waveguides on a single substrate, along with at least one optical function, as in the claimed invention.

The comments above regarding independent claim 1 also apply to independent claims 36 and 40. Thus, independent claims 36 and 40 are also allowable over the cited prior art.

The Examiner also rejected claims 5-13, claims 21-26, and claims 37-38 as being unpatentable over AAPA in view of the Wojnarowski patent and one of U.S. Patent No. 4,776,720 to Hammer (the “Hammer patent”), U.S. Patent No. 4,412,722 to Carnevale (the “Carnevale patent”), or U.S. Patent No. 5,955,749 to Joannopoulos (the “Joannopoulos patent.”) None of the additional references cited by the Examiner (the Hammer patent, the Joannopoulos patent, and the Carnevale patent) cure the deficiencies in the prior art noted above in connection with claim 1. Thus, Applicants will not address the subject matter of these references in detail. Because all of the dependent claims contain the limitations of the base claim and any intervening claims, the dependent claims are also allowable over the cited references for the reasons listed above.

As set forth above, Applicants have traversed the restriction requirement with respect to Groups I and III. The above comments with respect to independent claim 1 also apply to the

claims of Group III, claims 33-35 and claim 39. Applicants respectfully submit that these claims are also allowable.

Applicants respectfully request that the rejections be withdrawn and that the application be passed to allowance. Reconsideration and allowance are requested.

Respectfully Submitted,

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